

# FIRST RESULTS OF THE “MERMOSE” CAMPAIGN : INFLUENCE OF AIRCRAFT ENGINE THRUST ON PHYSICAL AND CHEMICAL PROPERTIES OF SOOT PARTICLES. A STUDY FROM THE MACROSCALE DOWN TO THE ATOMIC SCALE BY HRTEM, XPS AND NEXAFS.

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The air traffic increase of about 5%/year in the last decades and its foreseen growth have raised questions of environmental interest relative to air pollution resulting from airport traffic and human health at ground-level, and climate forcing due to gas and particles emissions at cruising altitudes [1]. Concerning this latter issue, soot aerosols' impacts on climate still remain at a low level of understanding and little is known about the aviation-induced cloudiness, a key in aviation's atmospheric impact, which includes linear contrails forming at the engines' exit and long-living artificial cirrus formed after ice nucleation on soot particles. Those phenomena strongly depend on the soot particles' ability to nucleate ice, which is related to the shape, size, structure, elemental composition and surface chemistry, but also depend on the fuel characteristics and combustion conditions (engine type, thrust regime) [2,3].

In this context, the “MERMOSE” project aims at studying physical and chemical characteristics of carbonaceous particles emitted from a Snecma/NPO-Saturn SaM146-1S17 turbofan engine (certified in 2010) fueled with Jet-A1, using the SNECMA test bench facility. Soot particles are studied across various length scales: macro, micro and nanoscale as a function of the engine thrust level by using complementary techniques such as High Resolution Electron Microscopy (HRTEM), X-Ray Photoelectron Spectroscopy (XPS) and Near Edge X-ray Absorption Fine Structure (NEXAFS). We present new results relative to the particles' shape, size distribution, texture, structure, elemental composition and chemical speciation [4]. We also show for the first time the existence of structural and chemical differences between carbonaceous crystallites respectively lying at the outermost part and the inner part of soot primary particles and we propose an atomic representation based on our measurements.

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